

GEOLOGICAL SURVEY GROUND WATER BRANCH

September 5, 1952

Memorandum:

To: Director, Engineering & Construction, Attn: F. E. Smith
AEC, Idaho Operations Office, Idaho Falls, Idaho

From: R. L. Nace, District Geologist.

U. S. Geological Survey, Boise, Idaho

Subject: Water Supply and Fluid-Waste Disposal at ANPR Site

Information and suggestions are furnished in response to a telephone request from Mr. Frank E. Smith, of your organisation, on September 2, 1952. Problems relate to water supply and waste disposal at the Aircraft Nuclear Propulsion Reactor Site on the National Reactor Testing Station, Idaho.

Geologic mapping of the area has been completed by the Geological Survey. Special studies of sediments are in progress. One test hole has been drilled and test pumped near the ANPR Site. A second test hole is in process of drilling, and a third test is planned. Chemical analyses of ground water pumped from the test hole are being made. An interim geologic report on a large area that includes the ANPR Site will be released as soon as drafting of the geologic map is completed. Advance copies of the map, in three sheets, already have been furnished to your office. Mapping of the water table is sufficiently advanced for immediate practical purposes. Results of chemical analyses of water from test-hole 24 will be available within a few days.

The attached information memorandum is a preliminary statement of highlights about the ground-water geology, to meet AEC needs for an immediate conference. The statements are preliminary and have not been approved for release by the Director of the Survey, but the final report on the area probably will not revise these statements materially.

I hope that these notes will meet your immediate needs.

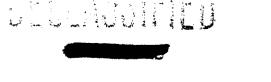
Very truly yours.

R. L. Nace District Geologist

Encl: 3 copies of Memorandum report to the state of the s

co: Chief, Ground Water Branch,
Washington, D. C. (in duplicate)
C. V. Theis, Albuquerque, New Mexico

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PRELIMINARY RECORDS
SUBJECT TO REVISION



UNITED STATES DEPARTMENT OF THE INTERIOR GEOLOGICAL SURVEY WATER RESOURCES DIVISION GROUND WATER BRANCH

MEMORANDUM:

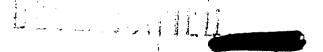
WATER SUPPLY AND WASTE DISPOSAL AT PROPOSED ANPR SITE
NATIONAL REACTOR TESTING STATION, IDAHO

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THIS REPORT HAS NOT BEEN EDITED FOR CONFORMANCE WITH SEP *GEOLOGICAL SURVEY EDITORIAL STYLE AND SUSSION STRATT-T GRAPHIC NAMES.

PREPARED IN COLLABORATION WITH THE United States Atomic Energy Commission

BOISE, IDAHO SEPTEMBER 5, 1952



WATER SUPPLY AND WASTE DISPOSAL AT PROPOSED ANPR SITE, NATIONAL REACTOR TESTING STATION, IDAHO

BY R. L. NACE

WATER DEMAND AND VOLUME OF WASTE

ANTICIPATED WATER-DEMAND FOR FACILITY: ABOUT 1,000 GALLONS A MINUTE FIRM SUPPLY, PLUS 1,000 GPM STANDBY AND EMERGENCY SUPPLY.

VOLUME OF NON-TOXIC INDUSTRIAL-WASTE FLUID: NOT KNOWN; MAY APPROACH

1,000 GPM AT TIMES. VOLUME OF ORDINARY SANITARY WASTE FLUID: NOT KNOWN; RELATIVELY SMALL AND PROBABLY ABOUT 20 GPM.

BASIC PROBLEMS

GROUND WATER IS THE SOLE ACCESSIBLE SOURCE OF WATER SUPPLY FOR THE ANPR. THE GROUND ALSO IS THE ONLY FEASIBLE PLACE FOR ULTIMATE DISPOSAL OF LARGE VOLUMES OF INDUSTRIAL FLUID WASTE. THE FOLLOWING TOPICS THEREFORE ARE OF BASIC IMPORTANCE:

- i. ADEQUACY OF THE GROUND-WATER RESERVOIR TO SUPPLY PERENNIALLY
 THE EXPECTED DRAFT BY PUMPAGE.
 - 2. HYDRAULIC GRADIENT; DIRECTION AND VELOCITY OF UNDERFLOW.
- 3. DESIRABLE LOCATIONS, CONSTRUCTION CHARACTERISTICS, AND SPACING OF WATER-PRODUCTION WELLS.
- 4. DEPTH TO WATER, DRAWDOWN DURING PUMPING, AND TOTAL PUMPING LIFT IN WELLS OF THE SPECIFIED CAPACITY.
 - 5. CHEMICAL QUALITY OF THE GROUND WATER.
 - 6. FEASIBLE TYPES OF FLUID-WASTE DISPOSAL FACILITIES.

7. LOCATIONS FOR WASTE-DISPOSAL FACILITIES AND THEIR SPACE RELATIONS TO OTHER FACILITIES, BOTH IN THE ANDREAS AND AT OTHER PRESENT AND POTENTIAL REACTOR AREAS IN THE NRTS.

INFORMATION IS NOT AVAILABLE ABOUT PROPOSED LOCATIONS FOR SPECIFIC PARTS OF THE ANPR FACILITY. THEREFORE DEFINITE LOCATIONS CANNOT BE RECOMMENDED FOR WELLS AND WASTE-DISPOSAL WORKS. THE PRINCIPLE CRITERIA FOR SELECTING SITES, HOWEVER, ARE RELATIVELY SIMPLE, AND AVAILABLE INFORMATION IS ADEQUATE TO GUIDE GENERAL PLANNING APPLICATIONS OF THESE CRITERIA.

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ADEQUACY OF THE GROUND-WATER RESERVOIR

AN ADEQUATE WATER SUPPLY IS AVAILABLE AT THE ANPR SITE. CAPACITY The second of th IS SUFFICIENT TO SUPPLY ALL FORESEEN NEEDS AND MUCH LARGER FUTURE The same of the second of the same of the same of the second of the same of th CONTINGENT NEEDS. THE TOTAL SUPPLY OF GROUND WATER THAT IS PERENNIALLY The control of the co AVAILABLE AT THE ANPR SITE IS NOT ACCURATELY KNOWN, SUT IT IS EQUAL Take may keep at the same and take safe Mark that the state of the stat TO MANY TIMES THE EXPECTED DEMAND OF THE PROPOSED REACTOR. THE WATER-BEARING MATERIAL IS CHIEFLY SHAKE RIVER BASALT, MANY LAYERS OF The Market Commence of the Com 医凯伊森氏 经产品债券 化 WHICH STORE AND TRANSMIT GROUND WATER VERY READILY. THE BODY OF Company of the Compan GROUND WATER BENEATH THE ANPR SITE IS PART OF A LARGER BODY THAT UNDERLIES THE ENTIRE SNAKE RIVER BASALT PLAIN IN SOUTHERN TOAHO. THE NRTS OCCUPIES A SEGMENT OF THE PLAIN THAT IS NEAR SOURCES OF SUSSTANTIAL RECHARGE BY UNDERFLOW FROM ADJOINING MOUNTAIN AND VALLEY AREAS. GROUND WATER IN THE NORTHERN PART OF THE MRTS IS RECHARGED CHIEFLY BY UNDER-FLOW FROM THE VALLEY OF BIRGH CREEK, AND FROM OTHER AREAS NORTH OF THE NRTS.

GEOLOGICAL SURVEY TEST-HOLE 24, DRILLED IN 1952 TO THE DEPTH IN THE OF 326 FEET, IS/NW\$SE\$ SEC. 13, T. 6 N., R. 31 E. THE DRILL PENETRATED ABOUT 50 FEET OF UNCONSOLIDATED FINE-GRAINED SEDIMENTS, AND 276 FEET OF SNAKE RIVER BASALT. FRACTURED AND PERMEABLE ZONES WERE PRESENT AT VARIOUS LEVELS IN THE BASALT, BOTH ABOVE AND BELOW THE WATER TABLE, WHICH IS 214 FEET BELOW THE LAND SURFACE; THUS THE HOLE PENETRATES 112 FEET OF BASALT IN THE ZONE OF SATURATION. A CONDENSED DRILLER'S LOG IS APPENDED. STUDY OF THE GUTTINGS AND PREPARATION OF A GEOLOGIC LOG IS IN PROGRESS. THE WELL CONTAINS 326 FEET OF 82-INCH I. D. CASING THAT IS PERFORATED AND SURROUNDED BY AN ARTIFICIAL GRAVEL PACK BELOW THE WATER TABLE. THE PERFORATIONS SQUARE PROVIDE ABOUT 4.2/FEET OF WATER-ENTRANCE AREA THROUGH THE CASING.

ON AUGUST 26 AND 27, 1952 THE WELL WAS TESTED BY PUMPING FOR 24 HOURS AT AN AVERAGE RATE OF ABOUT 350 SPM. DRAWDOWN AT THE END OF THE TEST WAS 4 FEET. THE MEAREST WELL IN WHICH OSSERVATIONS COULD BE MADE DURING THE PUMPING TEST WAS GEOLOGICAL SURVEY TEST-HOLE 7, ABOUT 12 MILES SOUTHWEST OF TEST-HOLE 24. INFLUENCE FROM PUMPING NUMBER 24 WAS NOT APPARENT AT NUMBER 7.

HYDRAULIC GRADIENT; DIRECTION AND VELOCITY OF UNDERFLOW

Test-Hole 24 is the northernmost point of established control on the water table in the NRTS. Other control points are from 2 to 8 miles distant in directions that range from southwest to northeast. Information is not available for areas north and northwest of test-hole 24. Third-order leveling has not been completed in this area,

李明蓝是一个大百世的一个人,这一个"_我是一个这样,我们是这个"我们",这是我们就想到这种一个现代,一个大概的一个可能的一个有人也<mark>是</mark>为他,这是的特殊是是他们

Bearing the way to the termination of

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BUT PRELIMINARY LEVELING INDICATES THAT THE ALTITUDE OF THE WATER TABLE AT TEST-HOLE 24 IS ABOUT 4,580 FEET ABOVE MEAN SEA-LEVEL DATUM OF 1929. PRELIMINARY INFERENCES, BASED ON SCATTERED DATA FOR THE PART OF THE NRTS IN TPS. 6 AND 7 N., ARE AS FOLLOWS:

- I. THE CONFIGURATION OF THE WATER TABLE CRASSENT IS FAIRLY SHOULD NOT THE WATER TABLE CRASSENT IS FAIRLY SIMPLE, WITHOUT APPARENT REGIONAL COMPLEXITIES. AS IN OTHER PARTS OF THE NRTS, HOWEVER, THERE DOUBTLESS ARE LOCAL COMPLEXITIES THAT WOULD INTRODUCE A FACTOR OF UNCERTAINTY IN PROBLEMS THAT INVOLVE THE HYDRAULIC GRADIENT AND LOCAL DIRECTIONS OF GROUND-WATER UNDERFLOW AT THE WATER OF THE
- 2. THE SLOPE OF THE WATER TABLE (HYDRAULIC GRADIENT) IS ABOUT THE TABLE (HYDRAULIC GRADIENT) IS ABOUT TO BE THE TABLE OF T
- ななら食の物質は食べい 食 一点 大学者 (GTA) としたはいいはないない (ATC) (TOTAL TOTAL TOTAL TRANSPORTS (ATAM) 3. THE DIRECTION OF SLOPE OF THE WATER-TABLE AT TEST-HOLE 24 18 也に 寸で図 学物館の ちゃくだこ BETWEEN SOUTH AND SOUTHEAST. WITHIN ! MILE OF THE TEST SITE THE LARGE WILL START SERVICES TO THE SERVICES SHEET SHEET THE MATTER WALLE PRINCIPAL REGIONAL DIRECTION OF GROUND-WATER UNDERFLOW PROBABLY IS 大震,最后要是这个最后的一点,可以是一个,但是一切是这些人,但是一个情况,这是其中的时候就是一个方式。一种特别的数,是有效的最后的第三人称:"这是一个 WITHIN A FEW DEGREES OF SOUTH-SOUTHEAST. SECAUSE THE WATER-BEARING 老是<mark>這個</mark>的一個作者,被各種的一個人。一個個個人的特別的工作物理,也是一個異樣的一個的人的一個人的工作。一個人的學術學,也是不是在19世界的 MATERIAL IS NON-HOMOGENEOUS, THE DIRECTION OF GROUND-WATER UNDERFLOW 後撃・10mm(10mm)(10mm)(10mm)(40 LOCALLY MAY DEVIATE CONSIDERABLY FROM THE GENERAL DIRECTION. FOR प्रशासिक राम्य अवस्थित र प्राप्त के विकास विद्यालया प्रथमिक राज्य र सम्बद्ध है। एक राम्य विद्यालया र SHORT DISTANCES THE DIRECTION OF UNDERFLOW MAY RANGE ANYWHERE BETWEEN 海南京 many not a national control of the control of SOUTHEAST AND SOUTH-SOUTHWEST.
- 4. The velocity of underflow is not known. Flow of water in the soft the control of the control





CONSTRUCTION AND LOCATION OF PRODUCTION WELLS

THE RANGE OF PERMEABILITY IN THE SNAKE RIVER BASALT IS LARGE,

BOTH VERTICALLY FROM LAYER TO LAYER, AND LATERALLY WITHIN INDIVIDUAL

LAYERS. LOCALLY BEDS OF FINE-GRAINED SEDIMENT ARE INTERCALATED

BETWEEN BASALT LAYERS AND THESE SEDIMENTS IMPEDE THE FLOW OF WATER.

WHERE THE BEDS OF SEDIMENT ARE THICK DEEP DRILLING MAY BE NECESSARY

TO REACH PERMEABLE WATER-BEARING ZONES.

FAVORABLE CONDITIONS ENGOUNTERED IN TEST-HOLE 24, SUCH AS
ABSENCE OF SEDIMENTS IN THE ZONE OF SATURATION, DO NOT ASSURE THAT
EQUALLY FAVORABLE CONDITIONS PREVAIL THROUGHOUT THE ANPR SITE. THE
WRITER IS CONFIDENT, HOWEVER, THAT CONDITIONS ARE FAVORABLE FOR THE
CONSTRUCTION OF EFFICIENT PRODUCTION WELLS WITHIN A FEW THOUSAND FEET
OF THE TEST SITE.

LARGE-BORE WELLS DRILLED 100 TO 150 FEET BELOW THE WATER TABLE

IN MATERIALS SIMILAR TO THOSE AT THE TEST-HOLE SITE WOULD YIELD UP TO

1,000 GPM EACH WITH DRAWDOWNS OF LESS THAN 5 FEET. DEEPER DRILLING

MAY BE NEGESSARY IF MUCH IMPERMEABLE BASALT OR SEDIMENT IS ENCOUNTERED

BELOW THE WATER TABLE. GEOLOGICAL SURVEY TEST HOLE 7, IN THE NULLEL

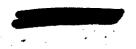
BEC. 27, T. 6 N., R. 31 E., IS 1,200 FEET DEEP AND PENETRATES CHIEFLY

BASALT BELOW THE WATER TABLE, WHICH IS 212 FEET BELOW THE LAND SURFAGE.

WATER-BEARING ZONES ARE PRESENT THROUGHOUT THE COLUMN OF ROCK DRILLED

BELOW THE WATER TABLE, AND EXTREMELY PERMEABLE MATERIAL WAS STRUCK

NEAR THE BOTTOM OF THE WELL.





IT IS RECOMMENDED THAT CONSTRUCTION OF WELLS DRILLED CHIEFLY IN BASALT AT THE ANPR SITE BE SIMILAR TO THAT OF WELLS AT THE CPP AND STR SITES. CASING SHOULD BE INSTALLED TO OR BELOW THE LEVEL AT WHICH THE INTAKE PIPE OF THE PUMP WILL BE SET. THE PUMP BOWLS SHOULD BE AT LEAST 25 FEET BELOW THE STATIC WATER LEVEL IN THE WELLS. THE PART OF THE HOLE BELOW THE PUMP SETTING NEED NOT BE CASED UNLESS IT IS IN UNSTABLE MATERIALS THAT MIGHT CAVE AND FILL THE UNCASED HOLE. PERFORATIONS IN THE CASING SHOULD PROVIDE AT LEAST SEVERAL SQUARE FEET OF ENTRANCE AREA FOR WATER, WITH THE HIGHEST PERFORATIONS BELOW THE EXPECTED LEVEL OF WATER IN THE WELL DURING PUMPING. THE ANNULAR SPACE BETWEEN THE CASING AND THE WALL OF THE HOLE SHOULD BE FILLED WITH CLEAN PEBBLE GRAVEL FROM JUST ABOVE THE STATIC WATER LEVEL TO THE BOTTOM OF THE CASING. THE GRAVEL PACK IN THIS TYPE OF WELL' IS AND MA SOLELY FOR PROTECTIVE PURPOSESS THAT IS STRUCTURE AND STABILIZES THE CASING AND PREVENTS CLOSGING OF PERFORATIONS BY FINE MATERIAL THAT MAY CAVE OR BE INTRODUCED FROM ABOVE. ABOVE THE GRAVEL PACK THE THERE SHOULD BE A CEMENT SEAL, AND THE REMAINDER OF THE SPACE ARGUND THE CASING SHOULD BE FILLED WITH PUDDLED GLAY OR NATIVE EARTH MATERIAL

FOR A WELL OF THE DESIRED CAPACITY THE MINIMUM FEASIBLE SIZE OF CASING TO THE DEPTH OF THE PUMP SETTING IS ABOUT 16 INCHES.O. D. WITH SMALLER CASING THE CHANGE OF WEDGING THE PUMP BOWLS BY FOREIGN OBJECTS ACCIDENTALLY DROPPED IN THE WELL IS TOO GREAT. ALSO, IF THE



PUMP COLUMN WERE DROPPED DURING INSTALLATION OR REMOVAL FOR REPAIR,

SMALLER CASING WOULD NOT ALLOW MUCH ROOM FOR MANIPULATING FISHING

TOOLS. SIXTEEN-INCH CASING WOULD PROVIDE ROOM FOR A PUMP LARGE

ENOUGH TO SUPPLY THE DESIRED QUANTITY OF WATER. IF FUTURE CONTINGEN
CIES INCLUDE POSSIBLE INSTALLATION OF A LARGER PUMP, 18-INCH CASING

WOULD ACCOMMODATE A PUMP THAT GOULD DELIVER 2,000 TO 3,000 GPM.

PROPERLY CONSTRUCTED 16- AND 18-INCH WELLS IN PERMEABLE BASALT

PROBABLY WILL YIELD 1,000 TO 3,000 GPM WITH A DRAWDOWN OF LESS THAN

25 FEET. THE EXPECTED TOTAL PUMPING LIFT THEREFORE IS LESS THAN

350 FEET. THE HYDROLOGY OF THE ANPR AREA IS POORLY KNOWN, HOWEVER,

AND EXPERIENCE IN HIGHLY PROBUCTIVE AREAS ELSEWHERE SHOWS THAT 10 TO

20 PERCENT OF WELLS ARE RELATIVELY POOR PRODUCERS. NEVERTHELESS

WELLS REGARDED AS "POOR" IN THIS AREA ARE POOR ONLY BY LOGAL STANDARDS.

BY AVERAGE STANDARDS ALL ARE GOOD TO EXCELLENT PRODUCERS.

IT IS RECOMMENDED THAT PRODUCTION WELLS FOR THE AMPR FACILITY

BE LOCATED IN THE SECTOR SETWEEN MORTHWEST AND MORTHEAST OF TEST-HOLE

24, AND PREFERABLY AT LEAST 500 FEET FROM THE TEST HOLE. THE LOCATION

FOR THE TEST WAS SELECTED IN ANTICIPATION THAT PRODUCTION WELLS WOULD

BE TO THE MORTH. ASSUMING THAT WASTE-DISPOSAL PACILITIES RECESSARILY

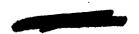
WILL BE TO THE SOUTH, THIS ARRANGEMENT HAS THE FOLLOWING ADVANTAGES.

LAND SURFACE. THEREFORE THE SEPTH TO WATER ON THE NORTH MAY BE SOME-WHAT LESS THAN IN TEST-HOLE 24, AND THE TOTAL PUMPING LIFT ALSO MAY BE LESS.



- 2. The test hole is part of a permanent network of observation and monitoring stations that have been established and maintained by the Geological Survey. It should be outside the fenced (exclusion) area of the ANPR to eliminate excessive security precautions ouring periodic visits by Survey personnel.
- 3. THE TEST HOLE SHOULD BE DOWN THE WATER-TABLE GRADIENT FROM PRODUCTION WELLS, BETWEEN THE PRODUCTION WELLS AND WASTE-DISPOSAL FACILITIES. IN THAT POSITION IT CAN BE USED FOR SEVERAL PURPOSESS (A) TO MONITOR THE CHEMICAL AND RADIOMETRIC QUALITY OF GROUND WATER MOVING THROUGH THE AREA! (B) TO DETECT ENGROACHMENT, IF ANY, OF CONTAMINATED WATER FROM WASTE-DISPOSAL AREAS BEFORE THE CONTAMINATION Company of the Control of the Control REACHES THE PRODUCTION WELLS: (C) DURING PUMPING OF PRODUCTION WELLS Williams will a train the second and the many carriers and one carriers a second of a TO MAKE OBSERVATIONS ON WHICH TO BASE CALCULATIONS OF HYDRAULIC and a single of the first of a consistency of washing in Front Health to the first in the consistency of the first COEFFICIENTS; (D) DURING DISCHARGE OF WATER TO THE GROUND THROUGH DISPOSAL WELLS TO MAKE OBSERVATIONS ON WHICH TO BASE CHECK CALGULATIONS OF HYDRAULIC COEFFICIENTS. DATA (C) AND (D) WILL PERMIT REASONABLY The second secon ACCURATE CALCULATION OF THE SAFE SPACING OF PRODUCTION AND DISPOSAL TO STATE OF THE STATE OF THE STATE OF Professional Control of the Marie Control of the Control WELLS. AT PRESENT ONLY ESTIMATES OF SAFE SPACING CAN BE MADE. 5. [[4][[[[[[]]]]] [[[]]] [[[]] [[[]]] [[[]] [[]]

THE RECOMMENDED DISTANCE BETWEEN PRODUCTION WELLS IS 500 FEET OR MORE. PRESUMBLY ONLY ONE WELL NORMALLY WOULD BE PUMPED AT A TIME. EMERGENCY OR INCREASED WATER DEMAND, HOWEVER, MAY NECESSITATE SIMULTANEOUS PUMPING OF TWO WELLS. MUTUAL INTERPERENCE SETWEEN WELLS LESS THAN 500 FEET APART MAY BE SUFFICIENT TO IMPAIR THEIR EFFICIENCY.





DEPTH TO WATER AND PUMPING LIFTS

AT RECOMMENDED LOCATIONS NORTH OF TEST-HOLE 24 THE DEPTH TO WATER MAY RANGE FROM 300 TO 325 FEET, DEPENDING ON THE SLOPE OF THE WATER TABLE AND THE ALTITUDE OF THE LAND SURFACE. THE DRAWDOWN IN EFFICIENT PUMPED WELLS MAY RANGE FROM LESS THAN I FOOT TO AS MUCH AS 25 FEET, DEPENDING ON THE RATE OF PUMPING, THE PERMEABILITY OF THE AQUIFER, AND THE AMOUNT OF PERMEABLE MATERIAL PENETRATED BY THE WELL. PUMPING LIFTS THUS MAY BE 350 FEET OR LESS. FOR PROPERLY CONSTRUCTED WELLS IN PERMEABLE BASALT THE ESTIMATED AVERAGE PUMPING LIFT IS

CHEMICAL QUALITY OF WATER

DURING PUMPING OF TEST HOLE 24 THE WATER CLEARED WITHIN A FEW MINUTES AFTER DISCHARGE BEGAN. THE WATER TEMPERATURE WAS 50 °F.

AFTER PROLONGED PUMPING FROM A LARGER WELL THE WATER TEMPERATURE MAY BE ONE OR TWO DEGREES HIGHER. WATER FROM GREATER DEPTHS ALSO IS APPRECIABLY WARMER. WATER PUMPED FROM TEST-HOLE 7, WITH THE PUMP CYLINDER 800 FEET BELOW THE LAND SURFACE, HAD A TEMPERATURE OF 66 °F.

SAMPLES OF WATER FROM TEST-HOLE 24 HAVE BEEN COLLECTED, BUT CHEMICAL ANALYSES HAVE NOT BEEN COMPLETED. ANALYSES OF WATER FROM TEST-HOLE 7 ARE AVAILABLE, BUT OWING TO SPECIAL GONDITIONS THE WATER FROM THAT WELL PROBABLY IS NOT REPRESENTATIVE OF WATER THAT WILL BE OBTAINED FROM ANPR WELLS. IT IS BELIEVED THAT THE GROUND WATER AT THE ANPR SITE IS SIMILAR TO THAT PUMPED FROM WELLS ELSEWHERE ON THE NRTS.





FEASIBLE TYPES OF FLUID-WASTE DISPOSAL

LIMITING GEOLOGIC CONDITIONS.—TERRETON LAKE, THE ANCESTOR OF MODERN MUD LAKE, WAS A LARGE BODY OF FRESH WATER WITH AN EMBAYMENT IN THE NORTHERN PART OF THE NRTS. SEDIMENTS THAT WERE DEPOSITED IN THE LAKE ARE CHIEFLY SILT AND VERY FINE SAND, WITH SOME CLAY. EAST OF TESTHOLE 24 THE LAND SURFACE IS FORMED BY THESE BEDS, WHILE TO THE WEST IT IS FORMED BY TERRETON LAKE BEDS AND SIMILAR FINE SEDIMENTS THAT ACCUMULATED IN MCDERN EPHEMERAL LAKES. THE PERMEABILITY OF ALL THESE BEDIMENTS IS VERY LOW.

A STREAM THAT ENTERED ANCIENT TERRETON LAKE FROM THE SOUTH BROUGHT SILT AND FINE SAND THAT FORMED A BROAD SAND BAR EXTENDING NORTHWARD THROUGH THE CENTRAL PART OF SEC. 13, T. 6 N., R. 31 E., INTO THE SOUTHEAST PART OF SEC. 12, AND THENCE TO THE CENTRAL EASTERN PART OF SEC. 11. PARTS OF THIS BAR ARE QUITE THIN AND LOW. THE AVERAGE EFFECTIVE WIDTH OF THE SAND BAR IS ABOUT 500 FEET, AND ITS EFFECTIVE HEIGHT IS ABOUT 10 FEET. THE SEDIMENTS IN THE SAND BAR ARE SOMEWHAT MORE PERMEABLE THAN THE LAKE-BOTTOM DEPOSITS.

THE SNAKE RIVER BASALT, WHICH UNDERLIES THE UNCONGLIDATED SEDIMENTS IN THE AREA, INCLUDES MANY HIGHLY PERMEABLE LAYERS THAT CAN ACCEPT AND TRANSMIT WATER VERY READILY. SOME LAYERS OF THE BASALT ARE IMPERMEABLE.

SANITARY WASTE. -- IT IS ASSUMED THAT ANPR SANITARY INSTALLATIONS WILL INCLUDE SEPTIC OR IMPOFF TANKS, OR SIMILAR DIGESTION WORKS, DISCHARGING ABOUT 20 CPM OF CLEAR FLUID EFFLUENT. THIS EFFLUENT PROBABLY GOULD





BE DISPOSED BY LEACHING BEDS OR OTHER INFILTRATION WORKS IN THE SAND-BAR SEDIMENTS. THE SAND BAR, HOWEVER, IS UNDERLAIN BY LAKE BEDS OF LOW PERMEABILITY, WHICH WOULD TEND TO PERCH THE DISPOSED WATER. PART OF THE WATER PROBABLY WOULD REAPPEAR AS SEEPAGE ALONG THE BASE OF THE SAND BAR AND MIGHT CREATE A LOGAL SANITATION PROBLEM.

EFFLUENT FROM SEWAGE WORKS MIGHT SE MIXED FOR DISPOSAL WITH INDUSTRIAL FLUID EFFLUENT. THE DILUTION FACTOR WOULD BE LARGE BUT, AS A GENERAL POLICY, THE IDAHO STATE DEPARTMENT OF PUBLIC HEALTH OPPOSES DISCHARGE OF SEWAGE EFFLUENT INTO PERMEABLE ROCKS AT OR NEAR THE WATER TABLE (SEE BELOW).

INDUSTRIAL WASTE.—DISPOSAL OF THE RELATIVELY LARGE VOLUME OF INDUSTRIAL WASTE FLUIDS IS A SPECIAL PROBLEM IN THE ANPR AREA BECAUSE THE UNCONSOLIDATED SEDIMENTS ARE TOO PINE GRAINED TO ABSORB AND TRANSMIT WATER
READILY. THE SIZE OF A LEACHING FIELD FOR THIS DISPOSAL WOULD BE
EXCESSIVE. ONLY TWO PRACTICAL ALTERNATIVES ARE APPARENT: (1) OPEN
SURFACE PONDS. AND (2) INTAKE WELLS.

(I) DISPOSAL MIGHT BE AT THE SURFACE IN LARGE NATIVE DEPRESSIONS, WHERE THE WATER WOULD BE DISSIPATED BY EVAPORATION AND BY SLOW INFILTRATION. Such a method would have numerous important drawbacks: (A) The water ultimately would inundate or permanently wet several hundred acres of Land. (B) The water would attract game animals. (C) Growth of water-Loving vegetation would be promoted and the area would be visited by waterfowl. (D) Wildlife interests probably would object



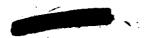
TO THE ARRANGEMENT. (E) RADIOACTIVE MATERIALS MIGHT ACCUMULATE IN SHALLOW EARTH MATERIALS BY ADSORPTION AND BASE EXCHANGE. ULTIMATELY THE BACKGROUND RADIOACTIVITY IN THE SURFACE SEDIMENTS MIGHT REACH AN UNDESTRABLE LEVEL.

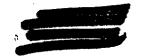
(2) DISPOSAL MIGHT BE IN ONE OR MORE INTAKE WELLS SUNK TO PEPMEABLE ZONES IN THE BASALT. THESE ZONES MIGHT BE EITHER ABOVE OR BELOW THE WATER TABLE.

AS A GENERAL RULE THE DISPOSAL OF UNDESIRABLE MATERIALS IN THE GROUND IS INIMICAL TO THE SAFETY OF GROUND-WATER SUPPLIES. THE SECLOGICAL SURVEY ORDINARILY DOES NOT RECOMMEND SUCH PROCEDURE. IN THIS INSTANCE, HOWEVER, THERE APPEARS TO BE NO PRACTICAL ALTERNATIVE. GROUND DISPOSAL OF WATER THAT CONTAINS NON-TOXIC CONCENTRATIONS OF RADIOACTIVE MATERIALS MAY BE SAFE IF THE AMOUNT AND CONCENTRATION OF RADIOACTIVITY IS CONTROLLED, IF THE EFFLUENT IS ADEQUATELY MONITORED, AND IF THE POINTS OF DISCHARGE ARE PROPERLY LOCATED. THE FOLLOWING SUGGESTIONS ASSUME A NON-TOXIC EFFLUENT THAT IS CAREFULLY MONITORED.

DISPOSAL WELLS.—A DISPOSAL WELL TO RECEIVE WASTE WATER CAN BE CONSTRUCTED BY DRILLING IN THE SNAKE RIVER BASALT. PERMEABLE LAYERS WAY BE ENCOUNTERED AT ANY DEPTH, AND SUFFICIENT INTAKE CAPACITY MIGHT BE DEVELOPED WITHOUT DRILLING ENTIRELY THROUGH THE ZONE OF AERATION.

On the other hand, it way be desirable to Drill into the Zone of Saturation. Both types of Disposal — in the Zone of Aeration, and In the Zone of Saturation — have Advantages and Disadvantages. Their





RELATIVE MERITS REQUIRE FURTHER STUDY AND IT IS SUGGESTED THAT FINAL SELECTION OF THE TYPE OF DISPOSAL. BE DEFERRED TEMPORARILY.

THEORETICALLY A WELL IN HOMOGENEOUS EARTH MATERIAL CAN TAKE IN

AS MUCH WATER AS CAN BE PUMPED OUT OF IT, PROVIDED THAT DURING INTAKE

A HEAD IS SUILT UP EQUAL TO THE DRAWDOWN CAUSED BY PUMPING. ALSO,

INCREASING THE HEAD WILL INCREASE THE INTAKE CAPACITY.

ALTHOUGH THE SNAKE RIVER BASALT IS NON-HOMOGENEOUS, A SATISFACTORY

DISPOSAL WELL CAN BE CONSTRUCTED IN ABOUT THE SAME MANNER AS A PROLESS
DUCTION WELL, BUT WITHOUT GRAVEL PACKING. ALSO/CASING IS NEEDED, AND
SMALLER DIAMETER IS ACCEPTABLE. CONSTRUCTION COST CAN BE FURTHER
CHEAPENED BY RELAXING ALINEMENT REQUIREMENTS IN THE WELL SPECIFICATIONS. SPECIAL PROVIBIONS ARE NECESSARY TO REDUCE AIR TRAPPING.

THE ESTIMATES MINIMUM SAFE DISTANCE FROM 1,000-GPM PRODUCTION

WELLS TO DISPOSAL WELLS IS 2,000 FEET. THIS ESTIMATE IS DERIVED FROM
CALCULATIONS BASED ON TESTS AND OBSERVATIONS IN THE CPP AREA. CONDITIONS AT THE ANPR AREA ARE NOT STRICTLY COMPARABLE AND THE ESTIMATE
OF 2,000 PEET IS FOR INTERIM PLANNING ONLY. AFTER THE FIRST PRODUCTION
WELL IS DRILLED, A PUMPING TEST SHOULD BE MADE, AND FROM THIS TEST A
BETTER ESTIMATE OF THE SAFE DISTANCE TO A DISPOSAL WELL MAY BE DERIVED.

IN ORDER TO AVOID CONTAMINATION OF ITS OWN WATER SUPPLY, THE ANPR DISPOSAL WELL SHOULD BE DOWN THE WATER-TABLE GRADIENT FROM PRODUCTION WELLS. THE ABOVE ESTIMATE OF SAFE DISTANCE ASSUMES A DISPOSAL WELL DIRECTLY DOWN THE MAXIMUM HYDRAULIC GRADIENT FROM PRODUCTION WELLS. IF ARRANGEMENT OF PLANT FACILITIES REQUIRES A

DIFFERENT ARRANGEMENT THE SAFE DISTANCE WILL HAVE TO BE RECALCULATED.

TABLE I. CONDENSED DRILLER'S LOG OF TEST-HOLE 24 (TERNIHOLOGY SLIGHTLY MODIFIED) THICKNESS DETAL (FEET) (FEET) CLAY /GLAYEY SLIT/. 50 50 BASALT, TRAYY. OREVICE AT 64.5 AND 78.5 - 79 FEET 29 79 BASALT, MODERATELY MARE GRAY 13 [23] BASALT, MODERATELY MARE GRAY 19. 142 BASALT, MODERATELY MARE GRAY 19. 145 BASALT, MODERATELY MARE GRAY 19. 145 BASALT, MEDIUM HARD RED AND GRAY 5 15 150 BASALT, MEDIUM HARD RED AND GRAY 10 - 176 BASALT, MEDIUM HARD RED AND GRAY 179 BASALT, RED NAD GRAY 179 BASALT, BROWN 1 187 BASALT, BROWN 1 188 BASALT, BROWN 1 187 BASALT, BROWN 1 187 BASALT, BROWN 1 188 BASALT, BROWN 1 187 BASALT, BROW		PRELIMINARY RECORDS SUBJECT TO REVISION		
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CLAY CLAYEY SILT 50 50	[2] A STATE TO A STATE OF THE STATE OF TH	THICKNESS OF DEPTH		
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